



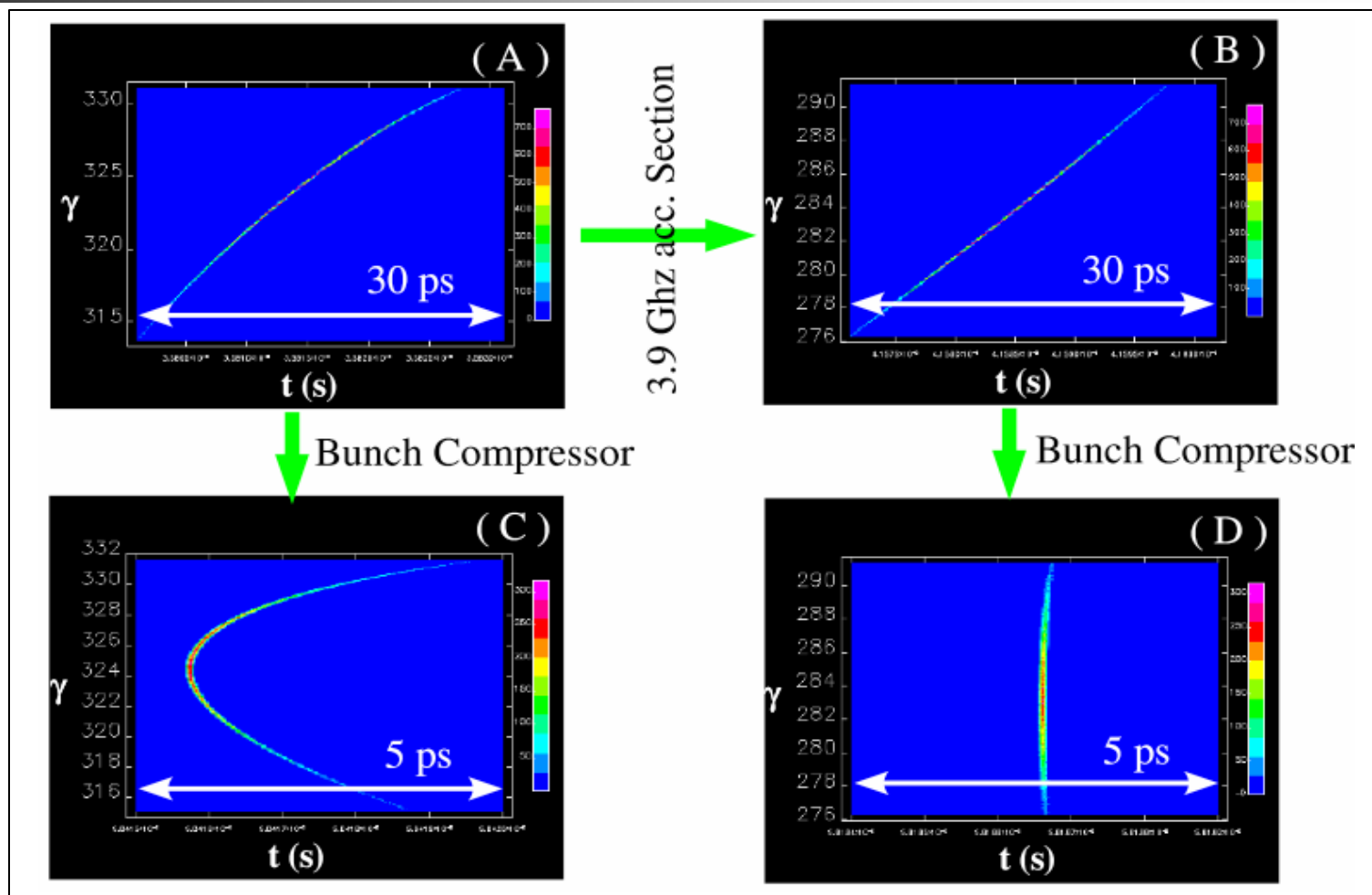
Project overview and organization

Nikolay Solyak

Outline

- TTF/FEL performances with 3rd harmonic cavity
- Goal and Deliverables
- Organization structure and responsibilities
- Prototyping and achieved results
- Design work
- Infrastructure development
- Cost/resources estimation

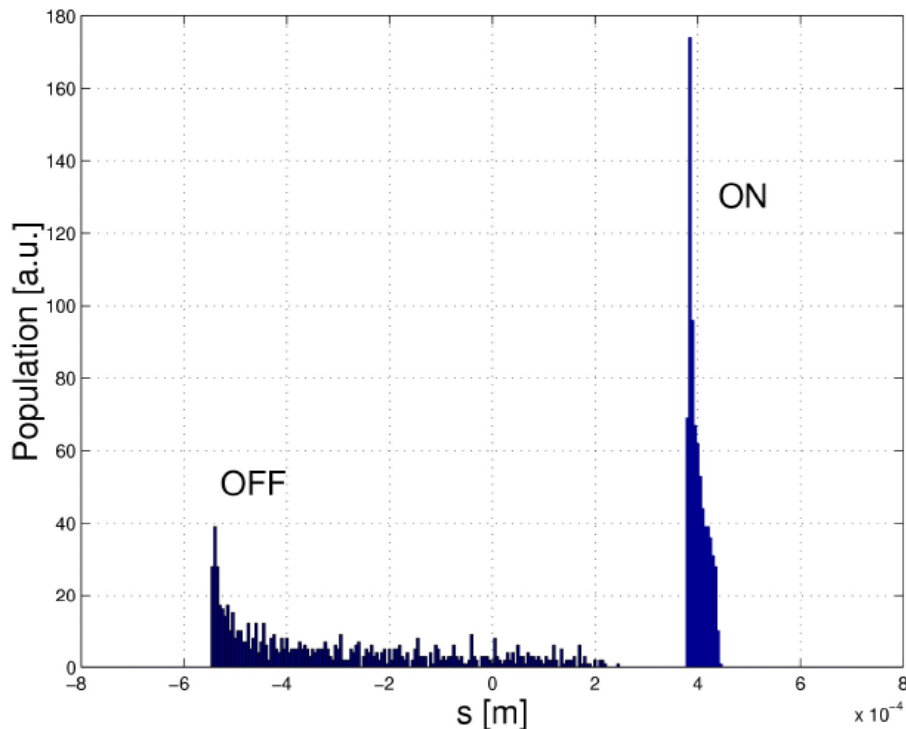
3rd harm. cavity to Improve Beam Characteristics



Energy distribution in the bunch before and after bunch compressor without (left) and with (right) the 3rd harmonic cavity, calculated for TTF photoinjector.

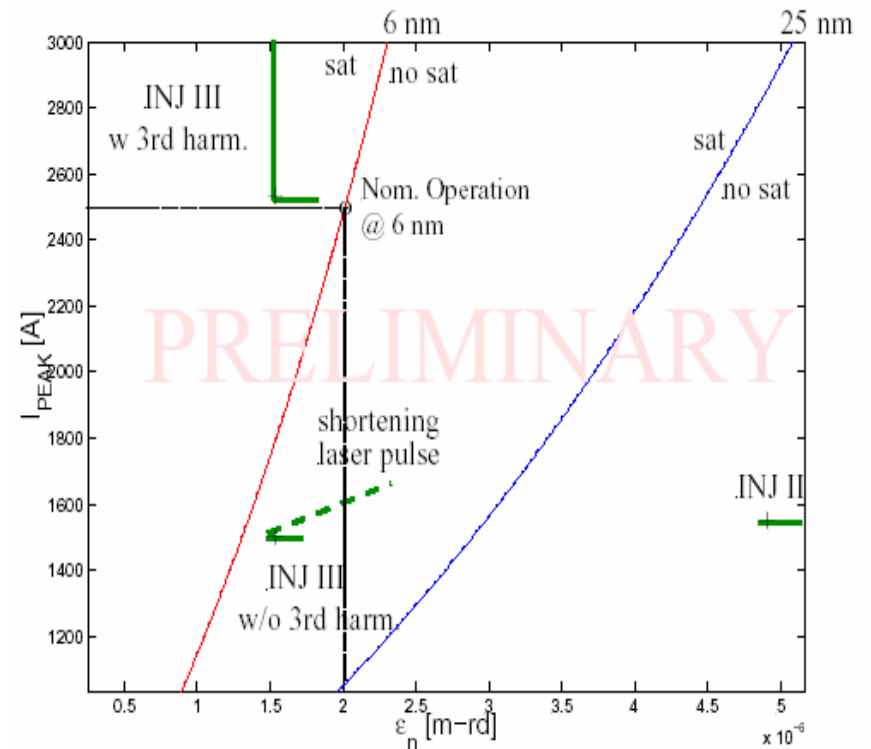
FEL at TTF-3 photoinjector with 3rd harmonic cavity

Bunch density with 3rd harmonic
section OFF/ON



Calculated by K.Floettmann/DESY

SASE regime



Requirements calculated by B. Faatz, DESY



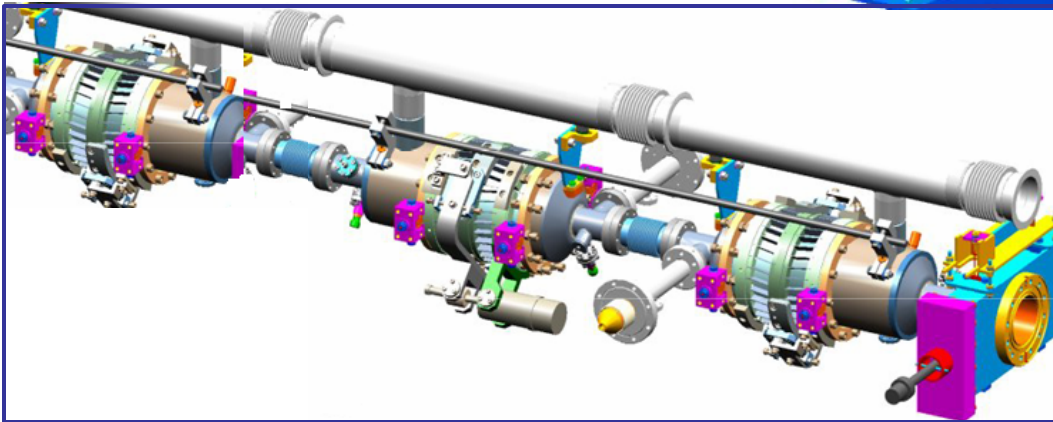
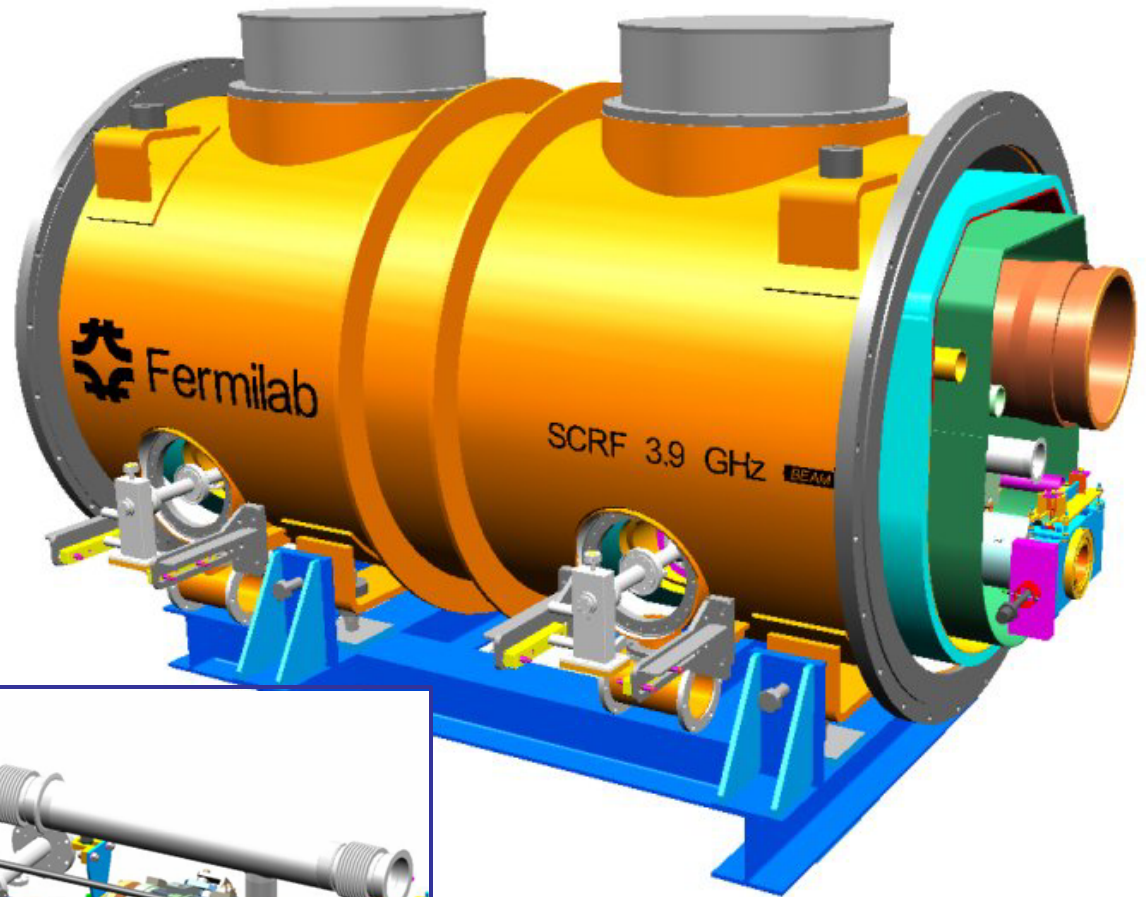
Project Goal and Deliverables

Develop SCRF infrastructure at Fermilab and build cryomodule with four 3.9 GHz cavities for TTF/FEL facility

- Cryomodule for 4 cavities
- 4+2(spares) dressed cavities with couplers.
- Tuners, magnetic shielding, assembly tooling
- All cavities have to be treated (BCP, HT, HPWR) tuned and tested in Vertical vessel (undressed cavity) and Horizontal cryostat (dressed cavity and coupler).
- Assembly cavity string & cryostat and ship to DESY.
- Assist with assembly at DESY

Deliverables

*Cryomodule
&
Cavity string*



D. Mitchell presentation



3.9 GHz Design & Fab. Staff

Management and coordination: H. Carter, H. Edwards, N.Solyak

Physicists:

- *N. Solyak*
- *L. Bellantoni*
- *P. Bauer*
- *J. Fast (PPD)*

RF Engineers:

- *T. Khabiboulline*
- *I. Gonin*
- *J. Li –PhD student*

Design Engineers:

- *D. Mitchell*
- *T. Peterson*
- *A. Stefanik (PPD)*
- *D. Olis*
- *E. Borissov*
- *V. Polubotko*
- *CM Lei*

Design & Drafting:

- *D. Arnold*
- *P. Belko*
- *G. Davis*
- *J. Mulvey*
- *G. Smith*
- *T. Sperry*

Chemistry:

- *A. Rowe*
- *C. Boffo*
- *I. Terechkine*

Cavity Fabrication:

- *M. Foley*
- *S. Reeves*
- *A. Beutler*

Cryomodule
Assembly:

- *T. Arkan*

Eng. Note &
Analysis:

- *E. Chi*
- *Z. Tang*
- *T. Salman*

Also Cryo staff, numerous technicians, machinists, and welders.

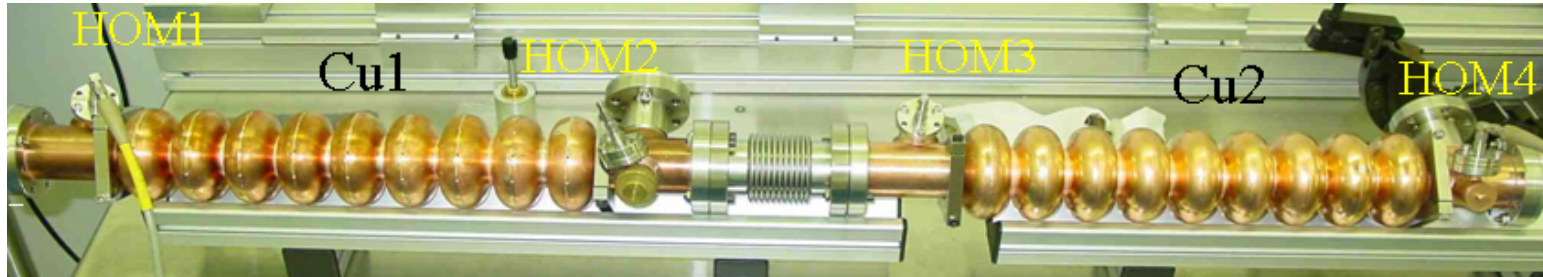


Responsibilities (cont.)

- Niobium inspection and surface studies – *P. Bauer / C.Boffo*
- *Cryomodule and cavity Design* – *D.Mitchell*
- *Horizontal cryostat* – *T. Peterson*
- Cavity Production – *M. Foley*
- RF measurement and cavity tuning – *T. Khabiboulline*
- Cavity Processing and dressing – *A. Rowe*
- Vertical Testing – *L.Bellantoni / T.Khabiboulline*
- Power Coupler RF processing – *N. Solyak / T. Khabiboulline*
- Cavity horizontal testing – *A. Hocker /*
- Cryogenic - *A. Klebaner / J.Theilacker*
- RF power and distribution system – *J.Reid*
- LLRF and data acquisition - *R. Cargagno / B. Chase*
- Cavity String & Cryomodule Assembly – *T. Arkan / A.Rowe*
- Shipping cryomodule to DESY/final installation: - *T. Arkan*

Prototyping

- Two copper cavities (cavity tuning, HOM studies –in each cavity and string of cavities, HOM damping, coupling, etc...)



- Niobium 3-cell cavity (Processing and performances studies)

Results:

$E_{acc}(\text{BCP only}) = 19 \text{ MV/m} \rightarrow (21 \text{ MV/m in 9-cell cavity; } 25 \text{ MV/m (TESLA)})$

Surface residual resistance = 6nOhm

- Two 9-cell cavities (1st under repair at JLAB, 2nd – Dec.2005).
- Two Blade-tuners (tested, now cold test)
- Cavity Helium vessel





Design work

- Cryomodule - (90%) complete
- Cavity – complete
- Cavity auxiliaries (tuner, vessel, shielding, bellows) - complete
- Horizontal cryostat - complete
- Main Input Coupler – complete

Additional design work

- Coupler processing test stand
- Minor design work for horizontal and vertical cryostat
- Tooling/fixture for cryomodule and cavity string assembly/shipping
- Design work to support Infrastructure

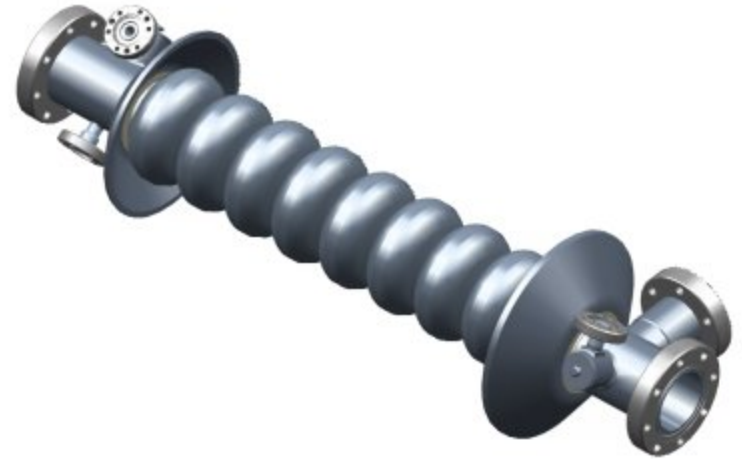
Cavity production

Cavity No.1&2 –prototypes (FNAL)

Cavities No. 3-6 (JLAB/FNAL)

Cavity No.7&8 spares (FNAL)

- All cavity parts are fabricating at FNAL, end-groups are welded at Sciaky.
- Cavity No. 1 complete: hole in equator of or cell. Repair November (JLAB).
- Cavity No. 2 will be ready in November/Dec
- Cavity No.3-6. End-groups are ready, all dumbbells are welded, measured and partly trimmed. – March 2006
- Cavities 7 and 8 partially (~ 60%) complete – April 2006



(Mike Foley presentation)



Infrastructure

Clean rooms:

- A0 class 10: cavity, cavity string assembly
- IB4 – RF measurements, cavity tuning
- MP9 – cryomodule assembly
- Mezon Lab

BCP:

- G150 @ANL –ready to start cavity processing
- Joint BCP facility at ANL – partly completed. Need UPW, some equipment, safety review and commissioning (beginning 2006)

HPWR, cleaning

- A0 clean room

Testing areas:

- Vertical cryostat A0
- Coupler processing - cave at Mezon Lab
- Horizontal cryostat – same cave at Mezon Lab

Cost estimations

Task Name	FTE Eng.	FTE Scient.	FTE Techn.	FTE Design	FTE Procur	M&S (\$)	Comments
Engineering Design & Drawings	0.24	0.00	0.00	0.75	0.00	\$0	FTE * Year
Procurement & Parts Acquisition	0.46	0.00	0.83	0.00	0.20	\$387,000	FTE * Year
Infrastructure	0.73	0.00	9.50	0.00	0.00	\$149,950	FTE * Year
Cryomodule Assembly	1.01	1.00	4.58	0.00	0.00	\$114,200	FTE * Year
TOTAL (FTE*year)	2.44	1.00	14.91	0.75	0.20	\$651,150*	

* Horizontal test stand, ANL/BCP Facility Setup Costs are not included.
All 3.9GHz related A0 operations costs are included.

(Tug Arkan presentation)